Strudel Cardiology Review

By Mike, Tate

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Cardiac Ischemia

58 yo M presents to the ED with 30-minute hx of "crushing" chest pain radiating to the left arm. Also notes shortness of breath, sweating, and nausea. EKG shows ST segment elevation of V1-V4. Dx, labs?

Anterior MI

Labs:

BMP, serial trops, CKMB (reinfarction)

EKG (especially first 6 hr): Peaked T waves, ST segment elevation, Q wave, T wave inversion

Initial meds?

MONA BASH-DAPT, heparin gtt., B blocker, ACE inhibitor, statin, O2 (hypoxic), nitroglycerin gtt or SL, morphine (pain after nitrate admin)

Consider diuretic for flash pulm edema-cannot be hypotensive

Monitoring: Vitals, Tele

Best revascularization?

PCI (door to balloon within 90 min)

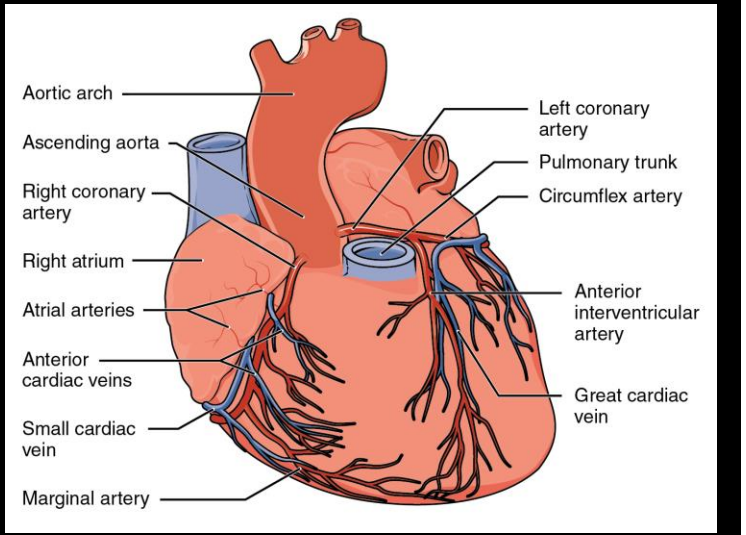
OR thrombolytic w/in first 6 hr

CABG?

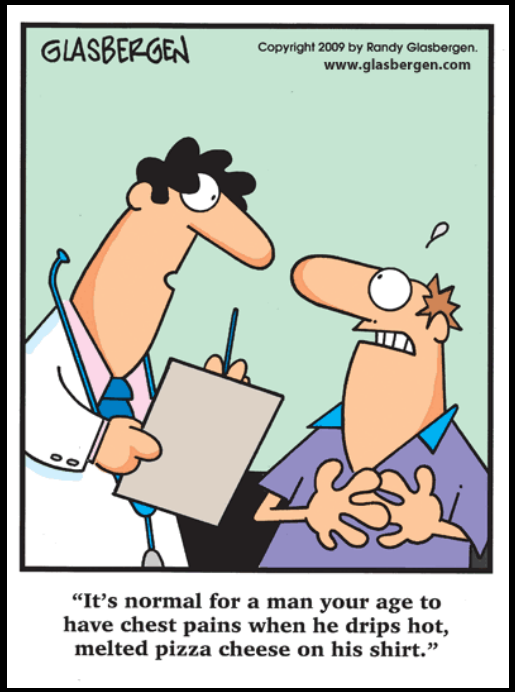
3 vessel disease, Left main

Pathophys:

Vessel thrombosis/plaque rupture



Case courtesy of Craig Hacking, Radiopaedia.org, rID: 83549



Cardiac Ischemia (cont)

Long term tx?

Cardiac rehab, ACE/ARB, statin, DAPT-12 months with DES

Optimize risk factors:

DM, HLD, HTN, smoking, age, FH, ESRD, HIV

Vessel involvement:

V1-V4

Anterior

II, III, avF

Inferior (Avoid ____?)

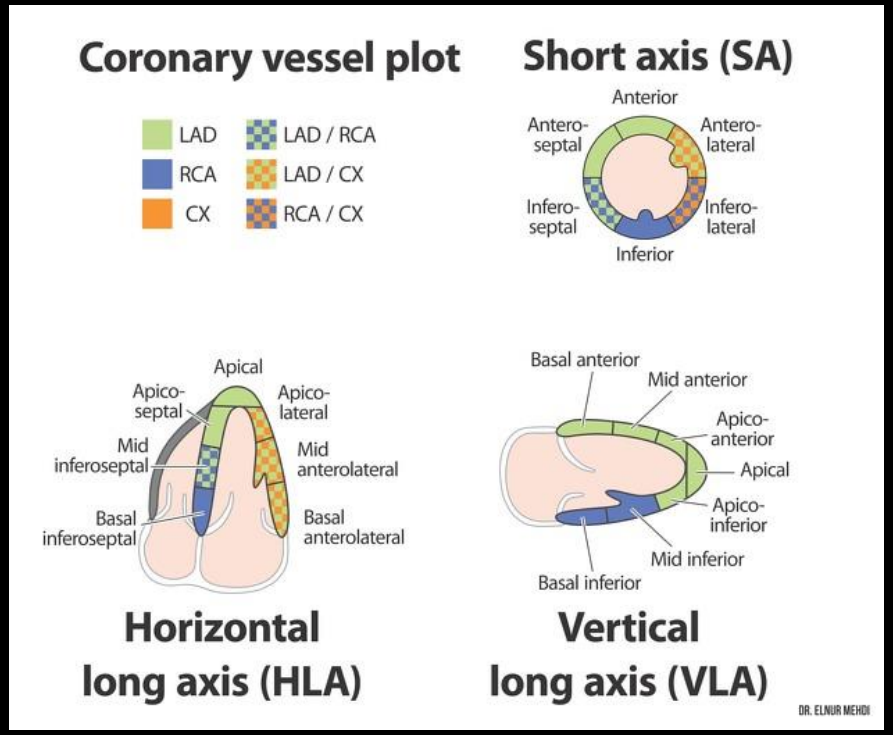
Nitrates

I, avL

Lateral

V1, V2

Septal

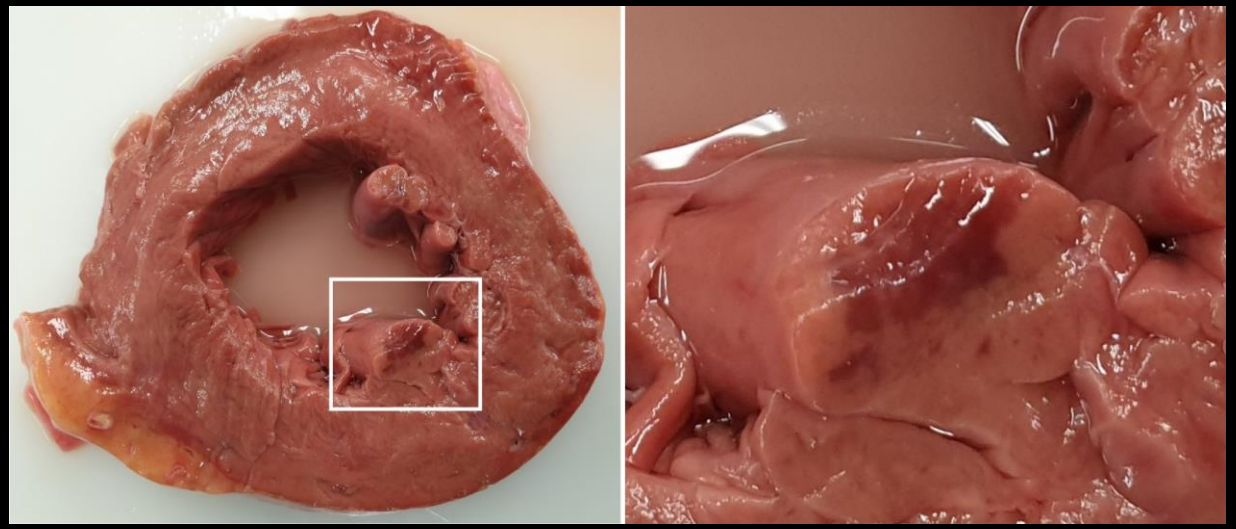


Case courtesy of Elnur Mehdi, Radiopaedia.org, rID: 52808

MI Complications

Most common cause of death several days following MI?
Arrythmia (ventricular)

3 days post PCI for RCA MI, a 60 year old pt presents with acute dyspnea, chest pain. On exam, auscultation reveals II/VI holosystolic murmur over apex, BP 85/50, HR 110, RR 25, O2 sat 91% RA. Dx?
Papillary muscle rupture
Pathophys?
Macrophage infiltration, posteromedial papillary muscle rupture (single blood supply from PDA)
Differentiate from septal rupture
Echo findings?
Non dilated LV, LA (acute), MR



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MI Complications

Patient develops chest pain 3 days after acute myocardial infarction. Friction rub audible on auscultation.

Acute postinfarction fibrinous pericarditis

Treatment

Supportive, avoid NSAIDs

Patient presents with holosystolic murmur over the apex, hypotension, tachycardia, dyspnea 5 days after acute MI.

Papillary valve rupture-Mitral regurgitation

Treatment:

Emergent surgical repair

Patient presents with cardiogenic shock, dyspnea, severe chest pain 10 days following acute MI. Holosystolic murmur heard over left lower sternal border. History significant for LAD occlusion.

Intraventricular septal rupture

What may be seen on cardiac cath?

Increased O2 saturation and pressure in right ventricle

Treatment:

Emergent surgical repair

MI Complications

Patient presents with hypotension, shortness of breath, acute chest pain 14 days after acute MI. Exam significant for elevated JVD, distant heart sounds. Electrical alternans seen on EKG.
Ventricular free wall rupture
What may be seen on TTE?
Cardiac tamponade, pericardial effusion

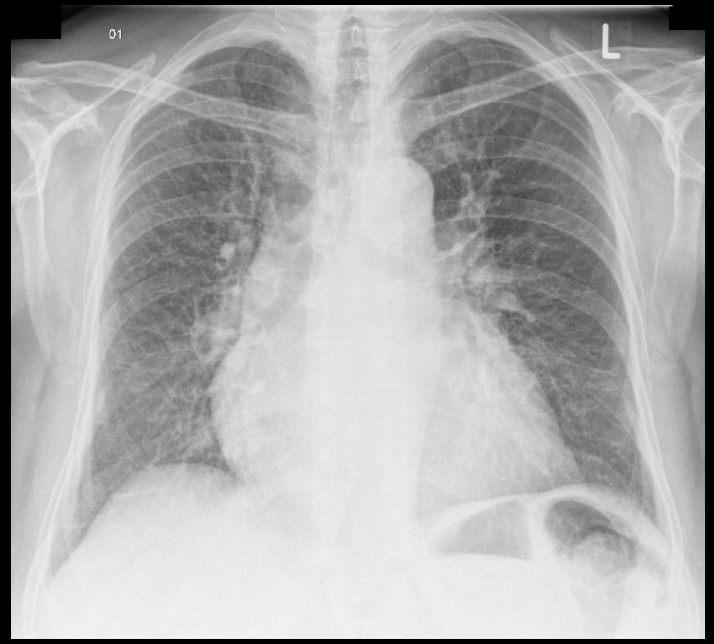
Patient presents with shortness of breath, lower extremity edema several weeks after acute MI. Exam significant for laterally displaced PMI. Best next step?
TTE
Diagnosis?
True ventricular aneurysm-contrast with ventricular pseudoaneurysm from scar tissue

Patient presents with chest pain that is worse with inspiration. Friction rub on auscultation.
Dressler syndrome (autoimmune fibrous pericarditis)
Treatment:
Supportive, NSAIDs

Cardio (CHF)

65 yo PMH HTN, recent MI several months ago with 3 months of progressive dyspnea, dry cough, now needs 3 pillow to sleep at night and wakes up 1-2x at night with trouble breathing. PE shows S3, laterally displaced PMI, S4, and bilateral crackles. 2+ LE edema. Dx?
CHF
Labs/Studies?
CBC, electrolytes, creatinine, CXR, TTE, BNP, EKG, lactate in shock
Imaging, labs in decompensated CHF?
Bedside cardiac US, CXR
ABG, BNP, ECG

Acute CHF Treatment?
Diuresis, respiratory support
Evaluate respiratory failure-CPAP/BiPAP if awake, Intubate if unconscious
If cardiogenic shock-inotropes, IV diuretic gtt
Admitted: Daily weights, diuretics, venodilation/afterload reduction, strict I/Os
Causes for acute exacerbation?
Med nonadherence, diet, infection

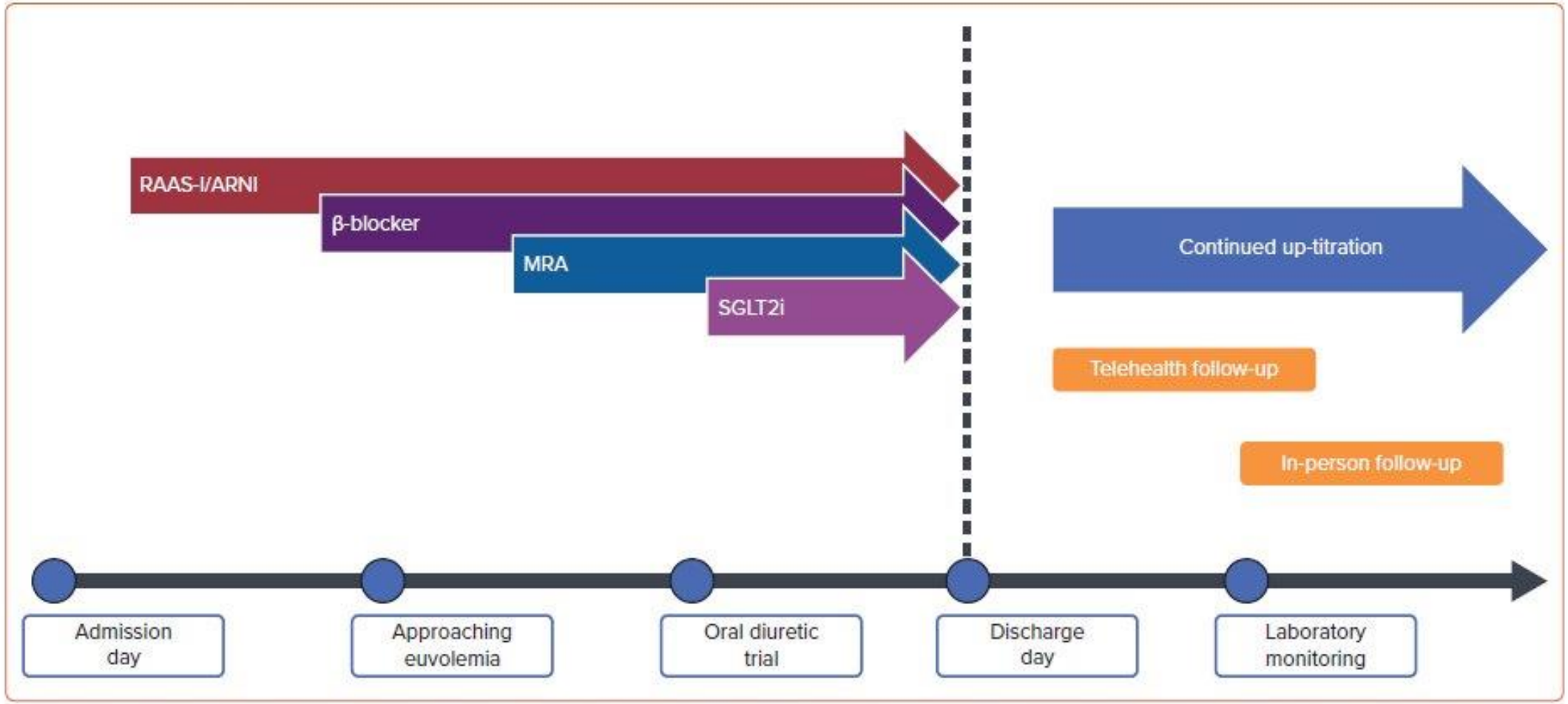


Case courtesy of Roberto Schubert, Radiopaedia.org, rID: 18991

Cardio (CHF cont.)

Most sensitive/specific exam finding?
HJR
MCC right sided HF?
Left sided HF
Types of CHF? (2)
HFpEF
Impaired diastolic failing->reduced CO
-HTN, sedentary lifestyle, obesity
HFrEF
Impaired systole
Increased preload does not increase cardiac output
Tx (Chronic)?
Diet: salt reduction, stop smoking, alcohol, exercise, vaccination, monitor weight
Sx meds: diuretics, dig
Meds that improve mortality: ACE, ARB, spironolactone, ARNI (Entresto), SGLT2, B blocker (GDMT)
VAD, LifeVest needed for severe HF. AICD after 3 month aggressive GDMT
MCC death in these pts?
Arrythmia
Risk fx?
HTN, obesity, ischemia, alcohol, cocaine, smoking, valvular heart disease

Figure 1: Shifting the Paradigm of Guideline-directed Medical Therapy Initiation



A suggested timeline of initiating guideline-directed medical therapy (GDMT) for patients admitted with heart failure with reduced ejection fraction during their hospitalization. ACEi = angiotensin converting enzyme inhibitor; ARB = angiotensin receptor blocker; ARNI = angiotensin receptor–neprilysin inhibitor; MRA = mineralocorticoid receptor antagonist; RAAS-I = renin-angiotensin-aldosterone system inhibitor; SGLT2i = sodium–glucose cotransporter-2 inhibitor.

US Cardiology Review 2021;15:e07.
https://doi.org/10.15420/usc.2020.29

Cardio (CHF)

75 year old gentleman with longstanding COPD, OSA now presents with abdominal pain, severe swelling. Lungs chronic expiratory wheeze but no crackles. 2+ pitting edema to midshin. Elevated JVP, positive HJR. TTE with pulmonary HTN.

Cor pulmonale

Labs/Studies?

CBC, electrolytes, creatinine, CXR, TTE, BNP, EKG, alk phos, ALT, AST

Cause?

Pulmonary HTN, right heart failure

Tx?

Diuresis, otherwise no significant data for role of other GDMT

Types of pulmonary HTN?

Group 1:

Pulmonary arterial hypertension

Group 2:

Pulmonary hypertension due to left heart disease

Group 3:

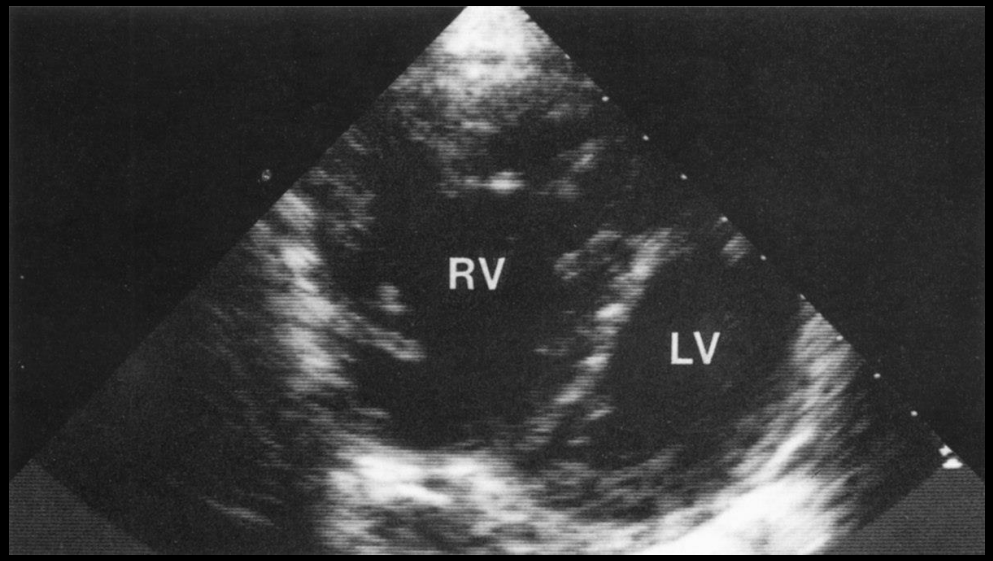
Pulmonary hypertension due to lung disease

Group 4:

Pulmonary hypertension due to chronic blood clots, microvascular occlusion

Group 5:

Pulmonary hypertension due to unknown causes



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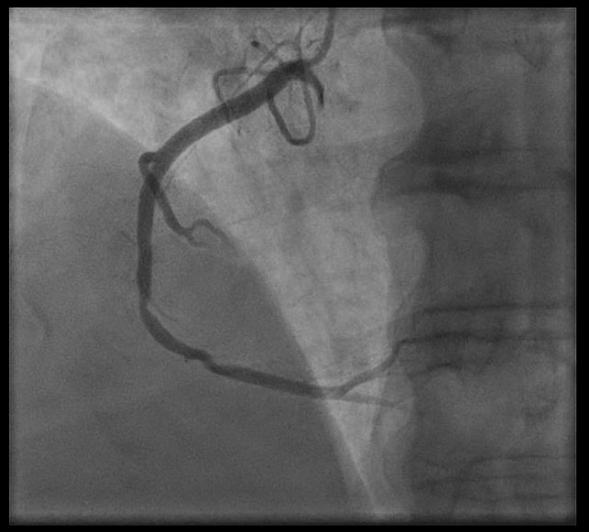
Cardiomyopathy

Ischemic vs nonischemic cardiomyopathy
Often systolic dysfunction

Diastolic dysfunction
Hypertensive cardiomyopathy

Right heart strain/Cor Pulmonale
Pulmonary HTN
OSA
COPD
PE



Case courtesy of Craig Hacking, Radiopaedia.org, rID: 63081

Cardiomyopathy

55-year-old with shortness of breath, orthopnea, lower extremity edema. Holosystolic murmur auscultated over the left fifth intercostal space. Lateral displaced PMI. No history of smoking, no significant ischemic cardiac risk factors. CXR demonstrating cardiomegaly. Multiple family members with similar presentation.

Diagnosis?

Dilated cardiomyopathy

Implicated gene?

TTN (Titin in sarcomere)

Inheritance pattern?

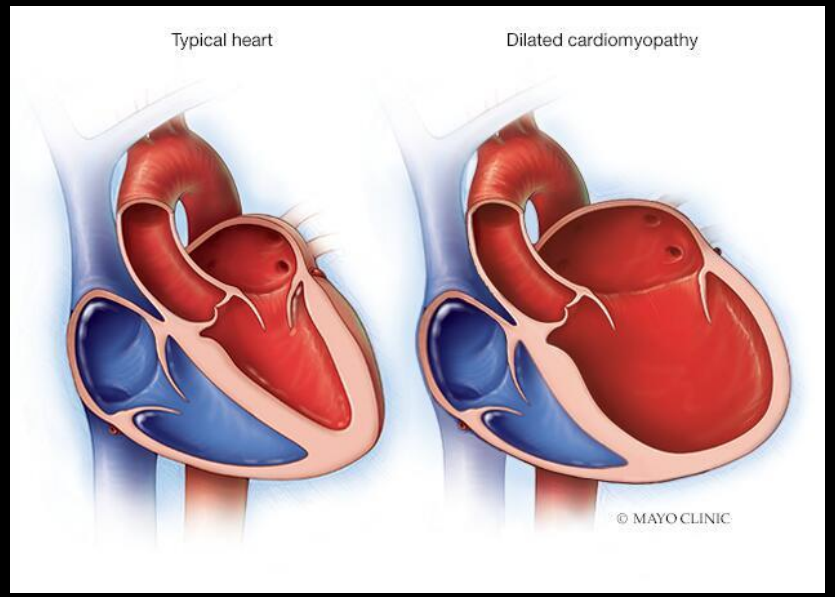
Autosomal dominant

Type of hypertrophy?

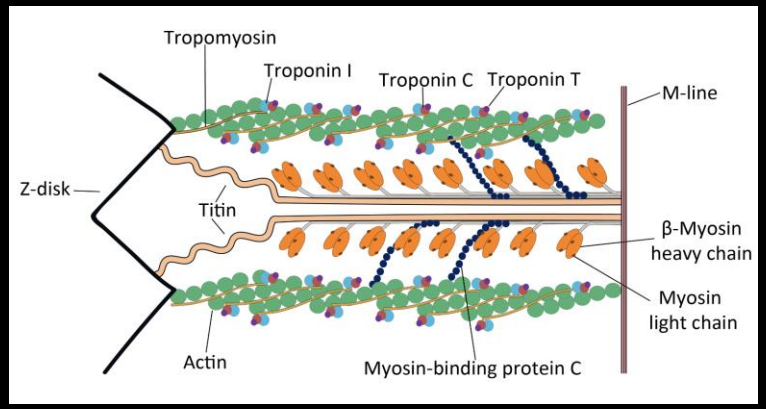
Eccentric

Treatment:

Similar to HFrEF-GDMT



Mayo Clinic MFMER



Mohamed Elshennawy, M.D., Wikimedia

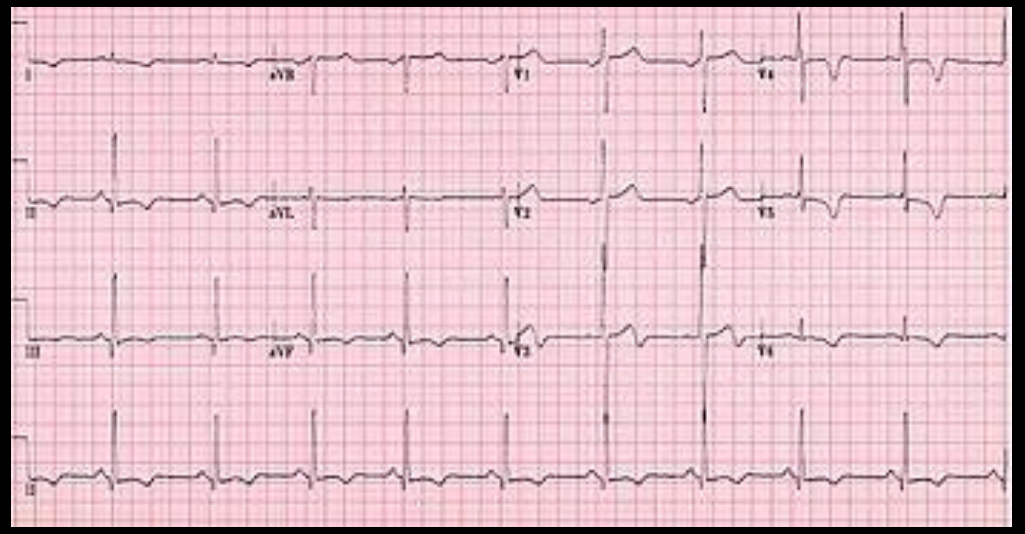
Cardiomyopathy

35 year old gentleman presenting with shortness of breath during exercise. Has gotten progressively worse over last several months. Also notes chest pain. FH significant for uncles who have had sudden cardiac death. Exam demonstrates holosystolic murmur over left lower sternal border which is louder with Valsalva maneuver. S4 audible.

Hypertrophic obstructive cardiomyopathy

Genes implicated?
Myosin binding protein C and β-myosin heavy chain)
Treatment?
Cease high intensity activity
β-blocker or non-dihydropyridine CCB
ICD

Type of hypertrophy?
Concentric
Interventricular septal hypertrophy



W.G. de Voogt, MD, PhD, via Wikimedia Commons

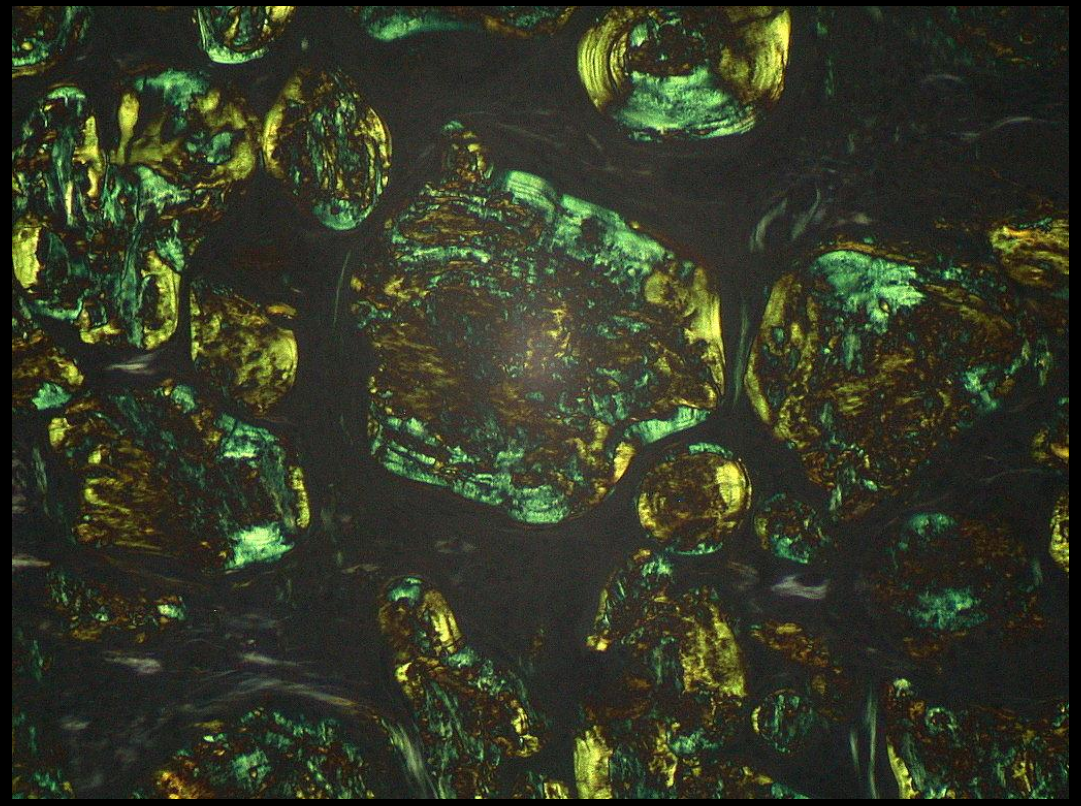
Npatchett, Wikimedia Commons

Cardiomyopathy

Patient presents with dyspnea, increased lower extremity swelling, orthopnea. Also found to have 4+ protein in urine.

Restrictive cardiomyopathy
2/2 Amyloidosis

EKG findings?
Low voltage EKG
Type of dysfunction?
Diastolic (filling)



Ed Uthman, MD via Wikimedia Commons

Cardiomyopathy misc. (Rapid review)

Other causes of heart failure:
Endocrine:
Thyrotoxicosis
Heme:
Anemia
Cardiac rhythm:
Tachycardia induced
Social history:
Alcohol, methamphetamine/cocaine us

Cardio

65 year old man with 2 hours post central line placement has shortness of breath, dizziness. Vitals: BP 80/50, HR 29, RR 25, O2 sat 92. On exam you note distant heart sounds, JVP 11 cm. Most likely dx and next step?

Cardiac tamponade (Becks triad)

If stable: TTE, also CXR, EKG

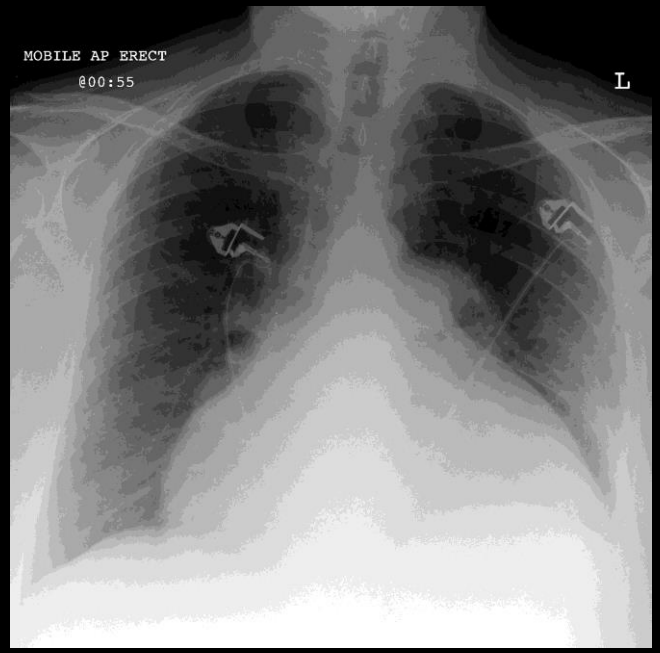
Tx?

Pericardiocentesis

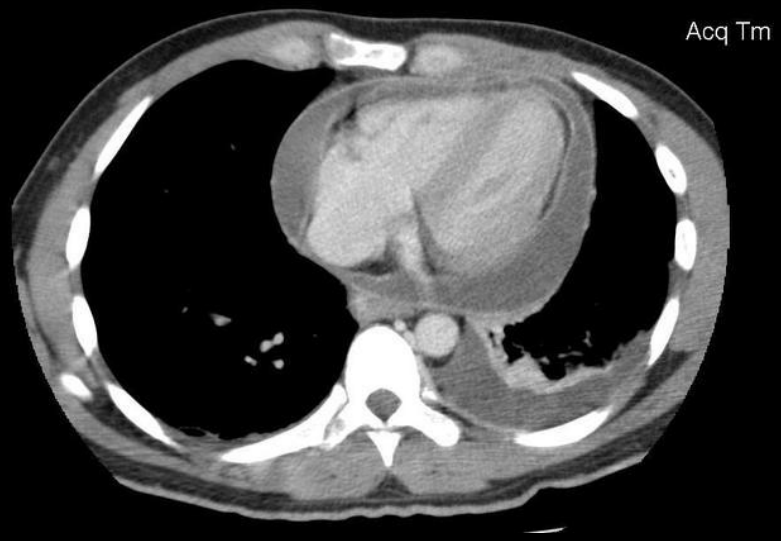
Causes?

Infectious, autoimmune, neoplastic, trauma, thyroid, medications, radiation

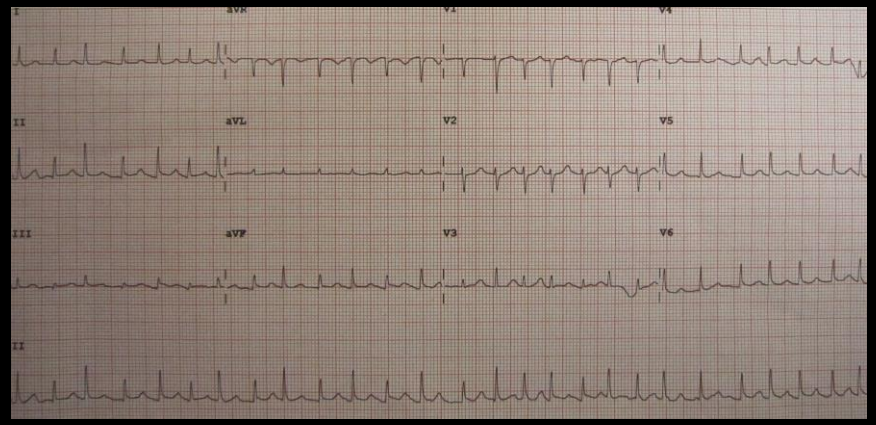
Differentiate from constrictive pericarditis



Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 7142



Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 7728



James Heilman, MD Wikimedia

Vascular

70 year old man PMH smoking, diabetes presents for 1 year history of bilateral leg pain. On history he notes this leg pain occurs every time he walks to his driveway to grab mail and back. The pain is relieved by hanging his foot over the side of his bed. On exam you note bl 2+ radial pulses and DP pulses only identified by Doppler. Best next test and most likely dx?

Ankle to brachial index (ABI)

PAD

Tx?

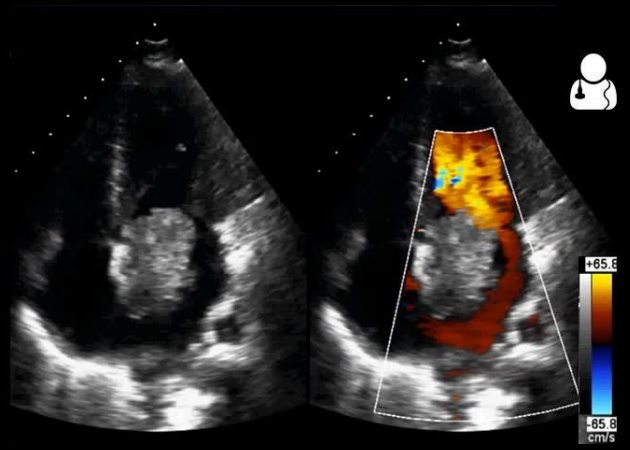
Smoking cessation, graduated exercise program, CAD risk factor management

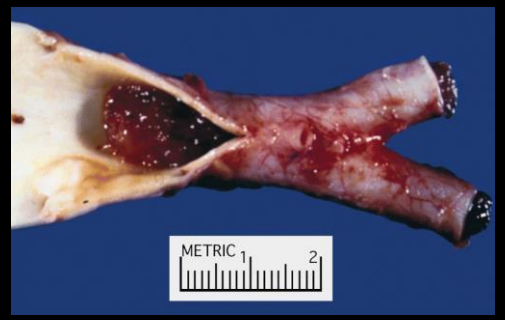
67 year old woman presenting following cardiac cath now with blue toes.

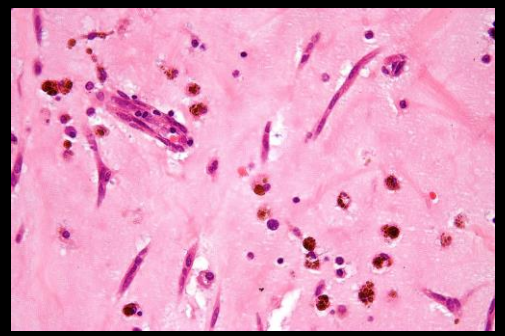
Cholesterol emboli

https://dermnetnz.org/topics/blue-toe-syndrome

Cardiac Neoplasms







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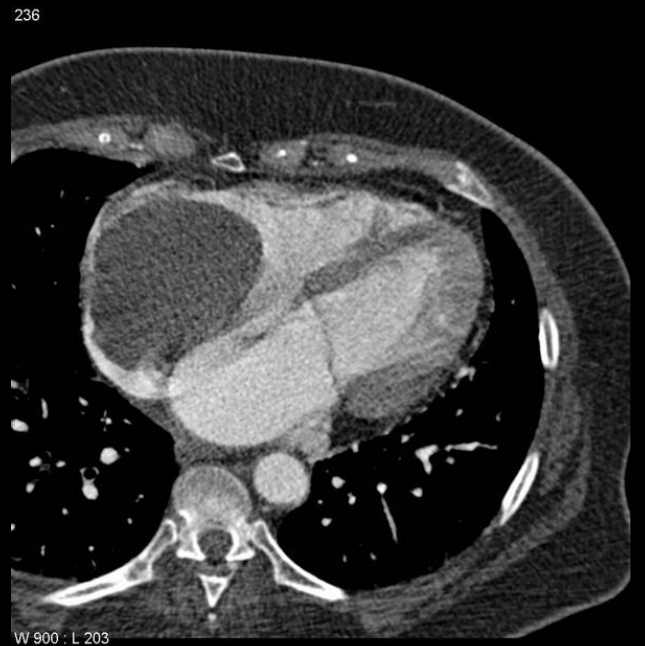
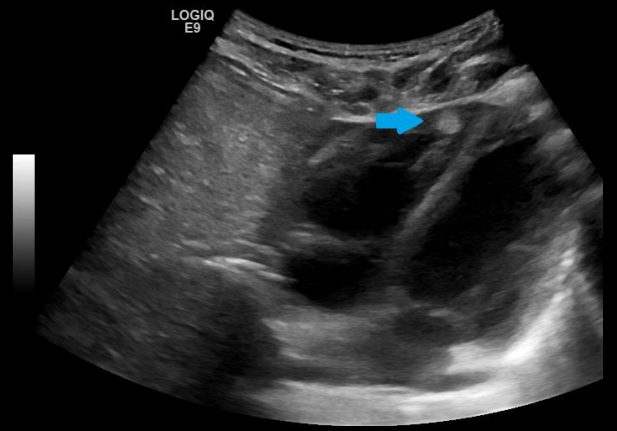
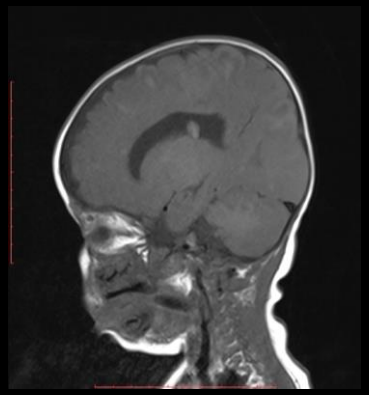
Cardiac myxoma



Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 8544

Cardiac metastasis





Case courtesy of Abdulmajid Bawazeer, Radiopaedia.org, rID: 70089

Cardiac Rhabdomyoma (Tuberous sclerosus)

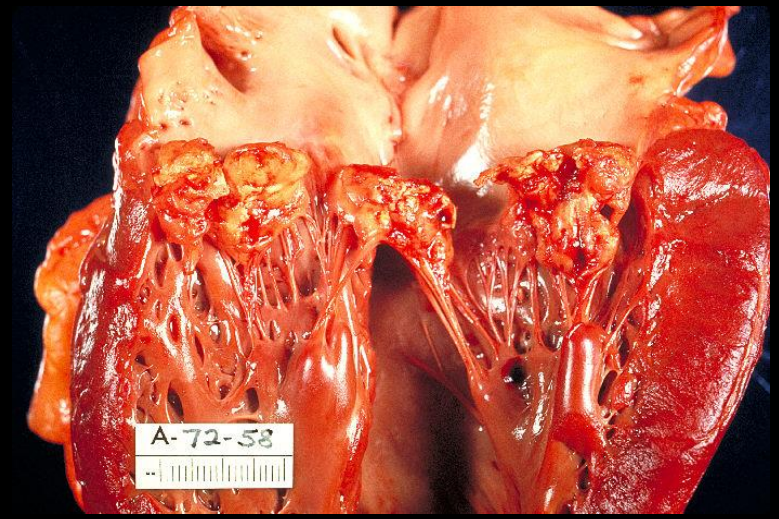
Cardiac Infections

35 year old gentleman presenting with 2 week history of fever, shortness of breath, night sweats. Exam significant for holosystolic murmur over left lower sternal border, painful erythematous spots over fingers. Diagnosis?
Infective endocarditis

Which valve likely affected?
Tricuspid
Likely organism
Staph aureus

Labs?

TTE vs. TEE, EKG, ESR, CRP, CMP, CBC w diff, blood cx (x3), UA



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Modified Duke Criteria	
Major criteria	(1) Positive blood cultures[a] 2 or more blood cultures drawn 12 h apart 3 or majority of ≥4 separate blood cultures, ≥ 1 hour from first to last (2) Imaging evidence of endocardial involvement Positive echocardiography (TOE)[b]
Minor criteria	(1) Predisposing heart condition/iv drug use (2) Fever, temperature >38°C (3) Vascular phenomena[c] (4) Immunologic phenomena[d] (5) Microbiologic findings[e]
Conclusion on infective endocarditis	
Confirmed infective endocarditis:	2 major criteria 1 major + 3 minor criteria 5 minor criteria
Possible infective endocarditis:[f]	1 major + 1 minor criteria 3 minor criteria

Doehner, W., Leistner, D. M., Audebert, H. J., & Scheitz, J. F. (2020). PMID: 33664634

Endocarditis

Treatment:

IV antibiotics determined by blood cx/sensitivity.

Empiric: vanc/gent

Remove intracardiac devices

Long duration of therapy.

Indication for abx ppx

Dr Graham Beards at en.wikipedia

15 year old girl with painful joints, new rash, shortness of breath, fever. Exam demonstrates new holosystolic murmur over the L fifth intercostal border, subcutaneous nodules, annular serpiginous erythematous rash. Workup?

TTE, ESR, CRP, CMP, CBC w diff

Dx?

Rheumatic fever

Cause?

Molecular mimickry w/ GAS

Major, minor criteria (Jones Criteria)

Joint, Carditis, Nodules, Erythema marginatum, Syndeham chorea

Tx?

Abx for strep pharyngitis if present

NSAIDs for acute rheumatic fever

Monitor CRP.

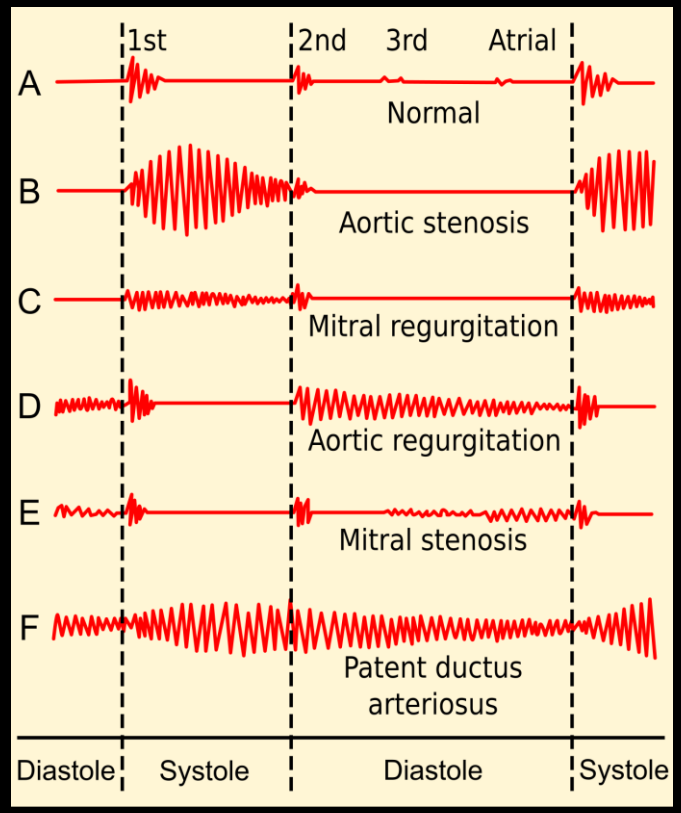
Indication for abx ppx

TABLE 74.2 2015 AHA-Revised Jones Criteria for Diagnosis of Rheumatic Fever*

MAJOR CRITERIA	
Low-Risk Populations	**Moderate- and High-Risk Populations**
Carditis (clinical or subclinical†)	Carditis (clinical or subclinical)
Arthritis (polyarthritis only)	Arthritis (including polyarthritis, monoarthritis, or polyarthralgia‡)
Chorea	Chorea
Erythema marginatum	Erythema marginatum
Subcutaneous nodules	Subcutaneous nodules
MINOR CRITERIA	
Low-Risk Populations	**Moderate- and High-Risk Populations**
Polyarthralgia	Monoarthralgia
Fever (≥38.5°C)	Fever (≥38°C)
ESR ≥60 mm in the first hour and/or CRP ≥3.0 mg/dL	ESR ≥30 mm in the first hour and/or CRP ≥3.0 mg/dL§
Prolonged PR interval, after accounting for age variability (unless carditis is a major criterion)	Prolonged PR interval, after accounting for age variability (unless carditis is a major criterion)

AHA

Valvular heart disease/murmurs



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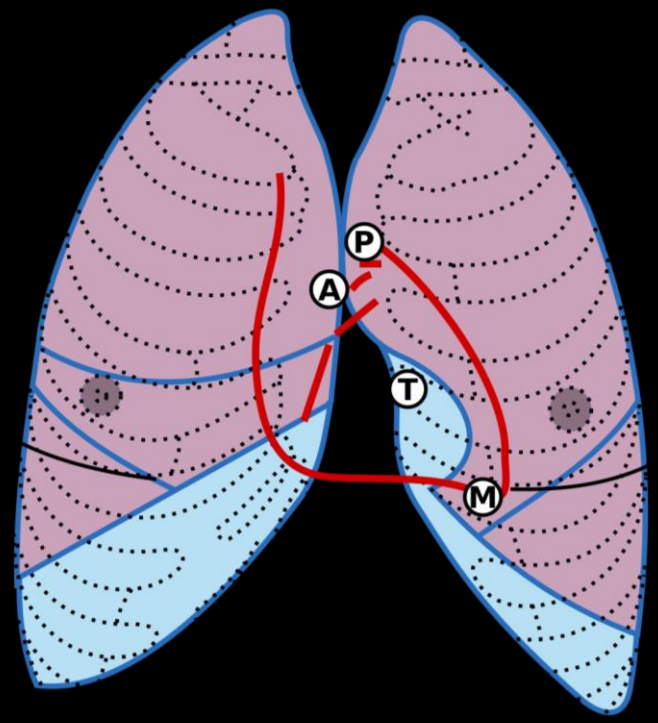

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Shock

Cold and dry
Hypovolemic shock
IV fluids

Cold and wet low LVEF
Cardiogenic shock
Diuresis, inotropes

Cold and wet (2)
Obstructive shock
Relieve obstruction

Warm and dry
Distributive shock
IV fluids, pressors

U.S. Navy photo by Stacey Byington, Public domain, via Wikimedia Commons

Vascular

55 yo M history of HTN presenting with severe, tearing chest pain radiating to back, hypertension, and asymmetric pulses

Diagnosis?

Aortic Dissection

Best Diagnostic Step

CTA Chest if stable

If unstable?

TEE in OR

Treatment?

Ascending (Stanford Type A) surgery

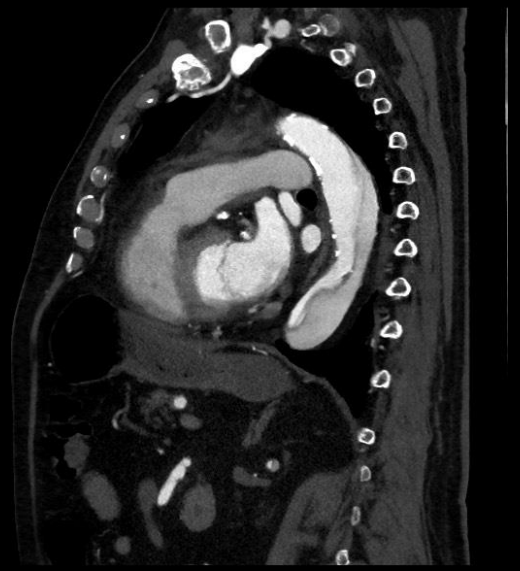
Descending (Stanford Type B) ? med management with BB

Pathophys?

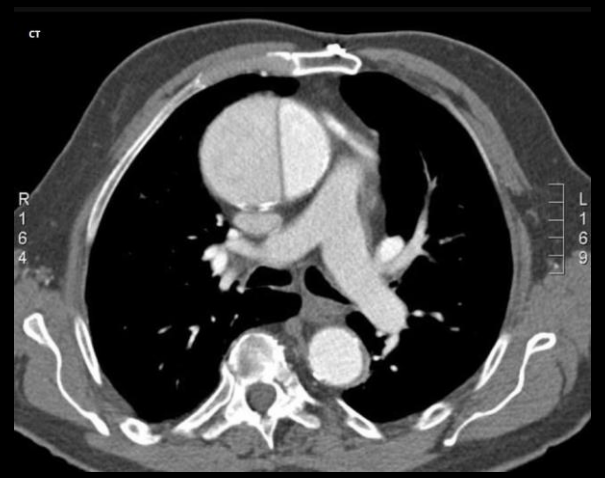
Intimal tear with a false/true lumen d/t HTN vs blunt trauma

High yield facts

-HTN most common RF



Case courtesy of Michael P Hartung, Radiopaedia.org, rID: 58462



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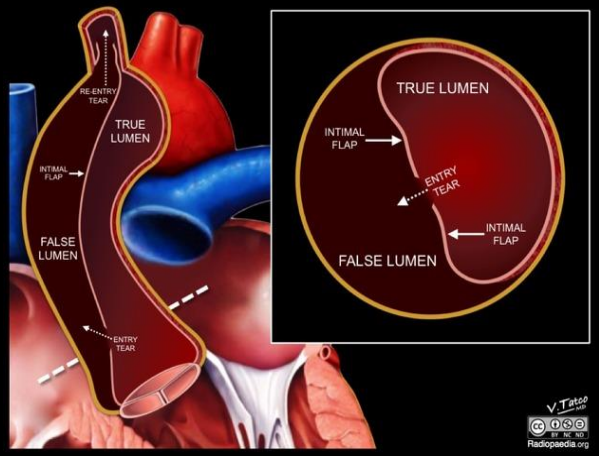


Case courtesy of Vincent Tatco, Radiopaedia.org, rID: 48452

65 yo M history of tobacco abuse presents with mild abdominal pain and pulsatile mass

Diagnosis?

Symptomatic AAA

Treatment?

>5.5 cm → surgical repair

<5cm → monitor

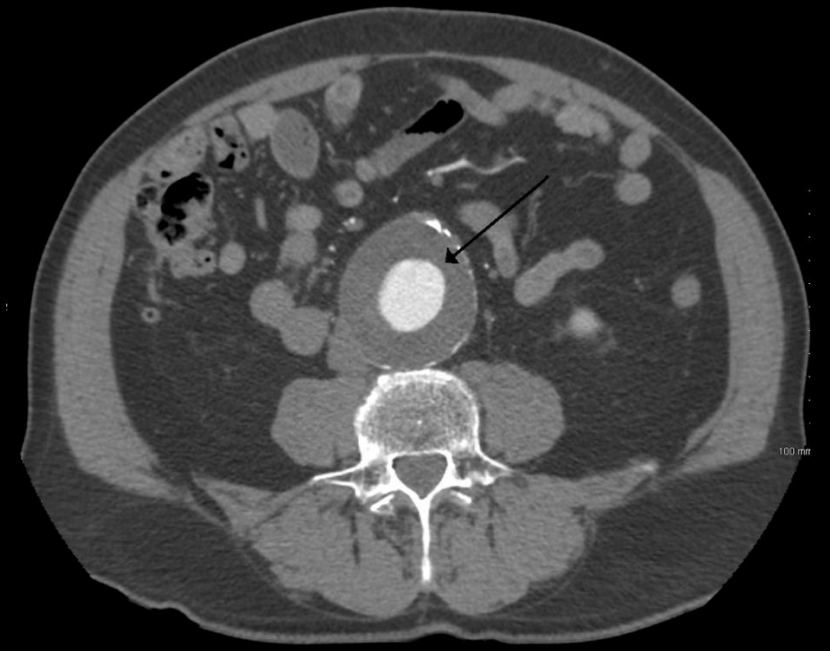
>5mm in 6 months → surgical repair

Pathophysiology?

Dilation of all three layers secondary to atherosclerosis

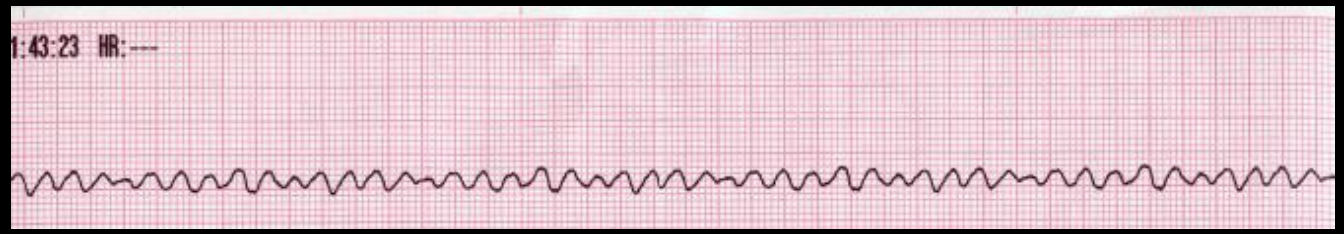
Screening?

65-75 w/ h/o tobacco abuse → one time US



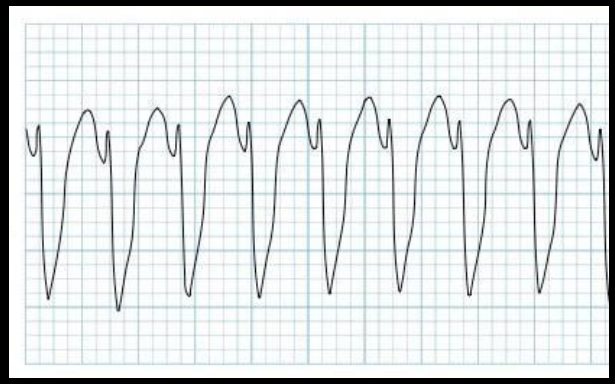
Wikipedia

EKG Rapid Dx (Ventricular)



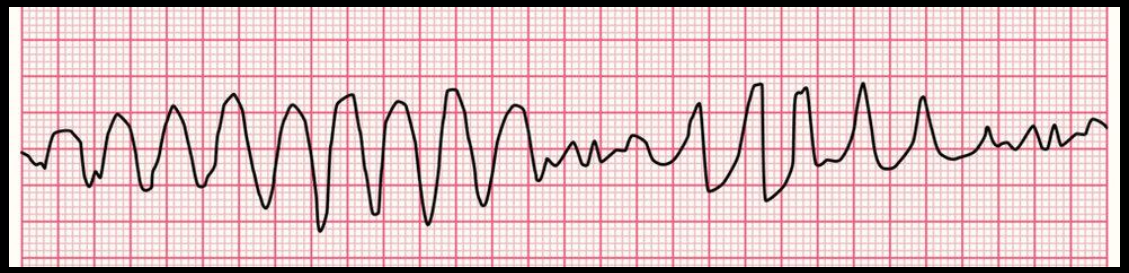
By Glenlarson - Own work, Public Domain, https://commons.wikimedia.org/w/index.php?curid=2599757

Dx?
Vfib
Tx?
Shockable rhythm: Epi+CPR, Defibrillation acutely
Pathophys:
Ventricles essentially fluttering- weak contractions



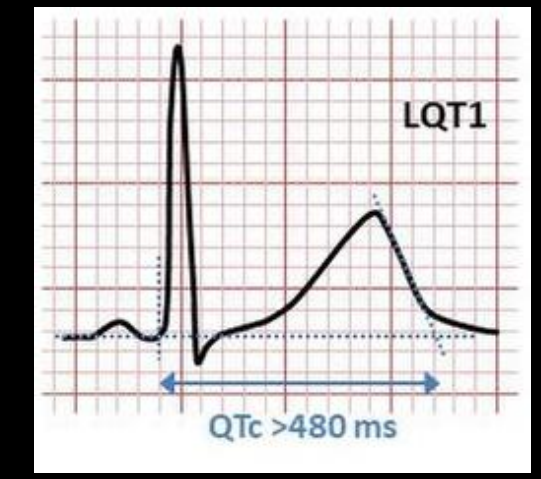
Dx?
Monomorphic Vtach
Tx?
Shockable rhythm: Epi+CPR, Defibrillation acutely if PEA
Synchronized shock if unstable
Medical tx?
Amiodarone

EKG Rapid Dx (Ventricular)



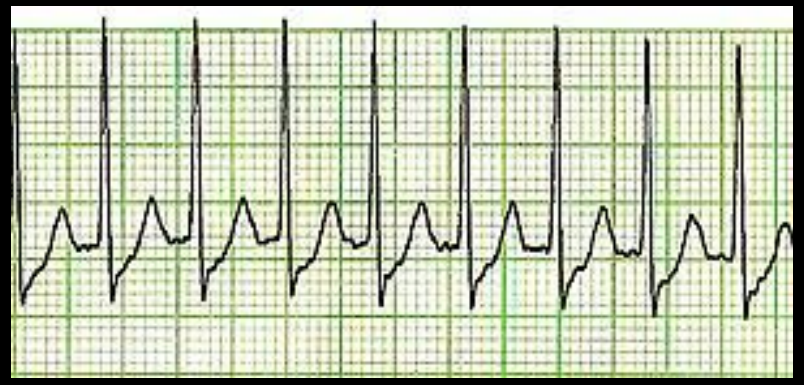
Adobe Stock Images

Dx?
Torsades de Pointes
"Twisting of points"
Tx?
If unstable: consider cardioversion
Medical: IV Magnesium, electrolyte repletion
Pathophys?
Look for things that lengthen QT interval
Medications

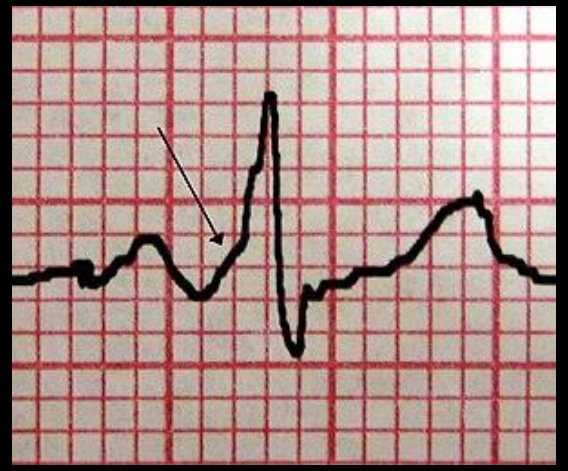


Dx?
Long QT
Tx?
Medications, electrolyte optimization (hypokalemia, hypocalcemia, hypomag) (TCA, methadone, antipsychotics, 1A, III, azoles, opioids, antiemetics-Zofran, prochlor)
Pathophys:
Acquired or Genetic
If associated with deafness?
Jervell and Lange Nielsen syndrome)

EKG Rapid Dx



Dx?
PSVT (SVT)
Tx?
Vagal maneuvers (carotid massage, ice water in kids)
Adenosine
Pathophys:
Nodal reentry



Dx?
WPW
Tx?
Procainamide (Avoid nodal blockers in afib-why?)
Pathophys:
Accessory pathway of Kent

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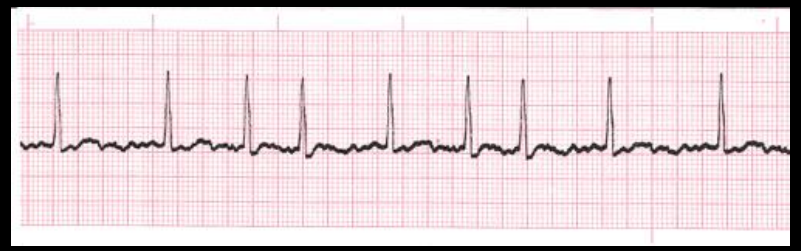
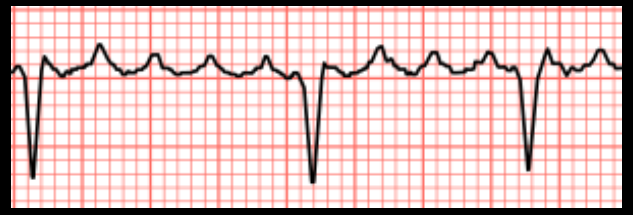
EKG Rapid Dx



ACLSonline.com

Dx?
Afib with RVR
Tx?
Chronic: Rate control vs Rhythm control
CHADS VASC-anticoagulation long term
Synchronized cardioversion if pt has no thrombus (by TEE) or is unstable
Meds: B-blocker/CCB (unless they have CHF), DOAC, Warfarin w/ heparin bridge
Pathophys:
Pulmonary vein automaticity focus
Risk factors for afib:
CHF, LA dilation, valvular disease, COPD, hyperthyroid/catecholamine excess, stress, alcohol (holiday heart)



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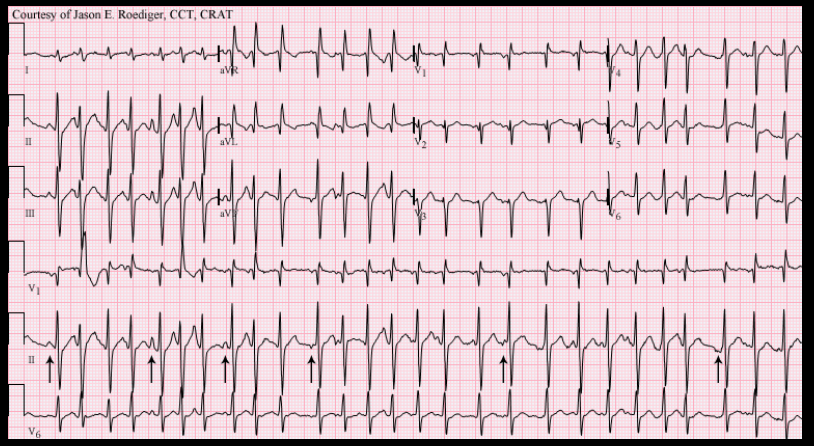
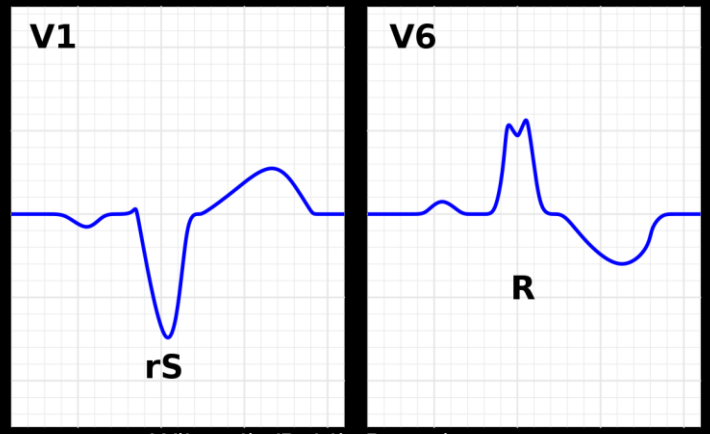
Dx?
Atrial flutter
Tx?
Similar to Afib
Often harder to treat
Can ablate Tricuspid annulus
Pathophys:
Tricuspid annulus reentrant circuit



Dx?
Multifocal atrial tachycardia (MAT)
Criteria for diagnosis?
3 or more distinct P waves in same lead
HR>100
Irregular PP intervals
Often PR interval variability
Tx?
Treat underlying cause
Non-dihydropyridine CCB, BB, ablation
Pathophys:
Wandering atrial pacemaker, impulse has alternating foci within atria

EKG Rapid Dx



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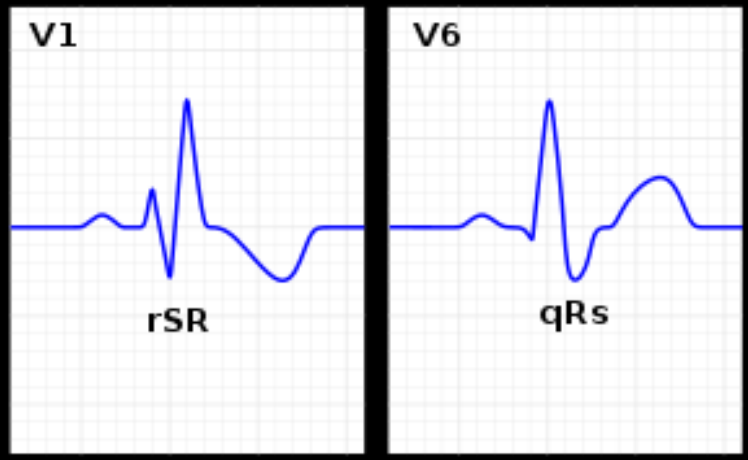
Dx?
LBBB



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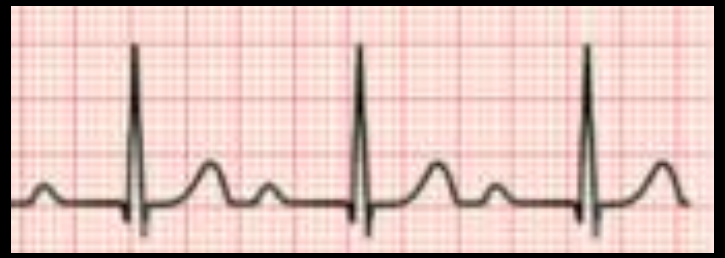
Dx?
RBBB

EKG Rapid Dx



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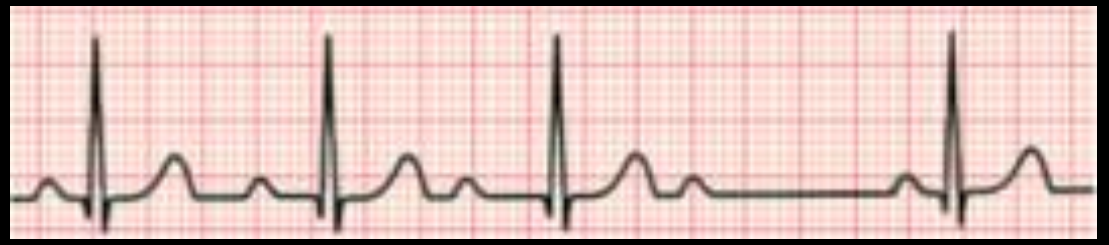
Dx?
1st degree av block
Tx?
Benign, observation
Consider atropine if unstable
Pathophys:
Intranodal block



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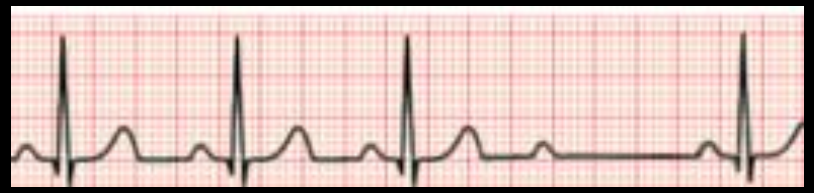
Dx?
2nd degree av block Mobitz I
Tx?
Benign, observation
Consider atropine if unstable
Pathophys:
Intranodal block



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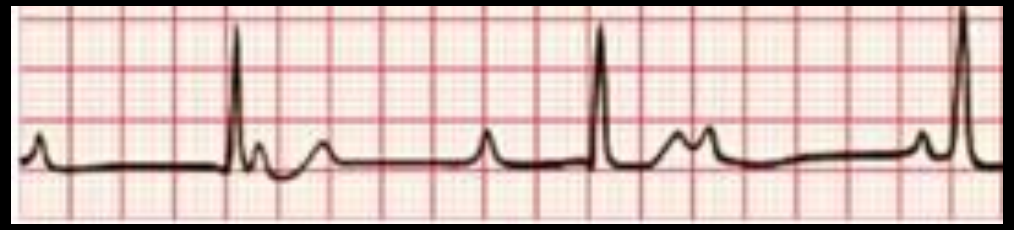
Dx?
2nd degree av block Mobitz II
Tx?
Pacing
Pathophys:
Block below AV node



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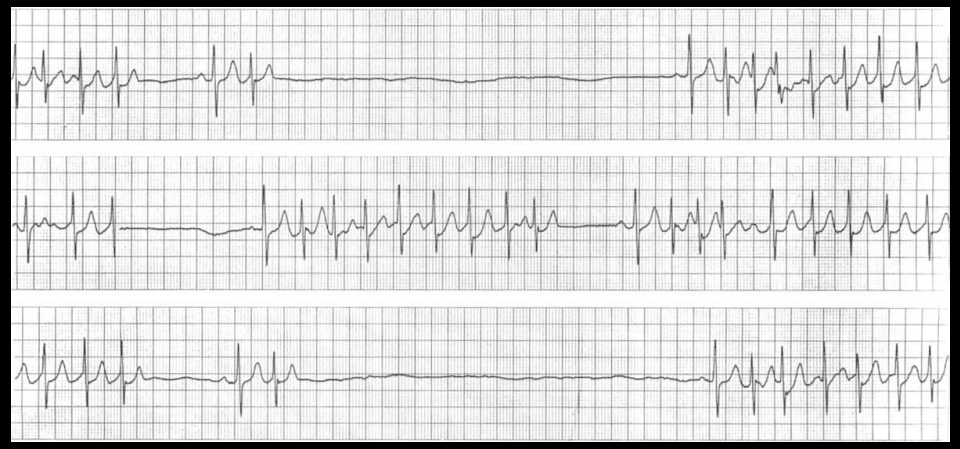
Dx?
Third degree AV block
Tx?
Pacing
Pathophys:
Block below AV node

EKG Rapid Dx



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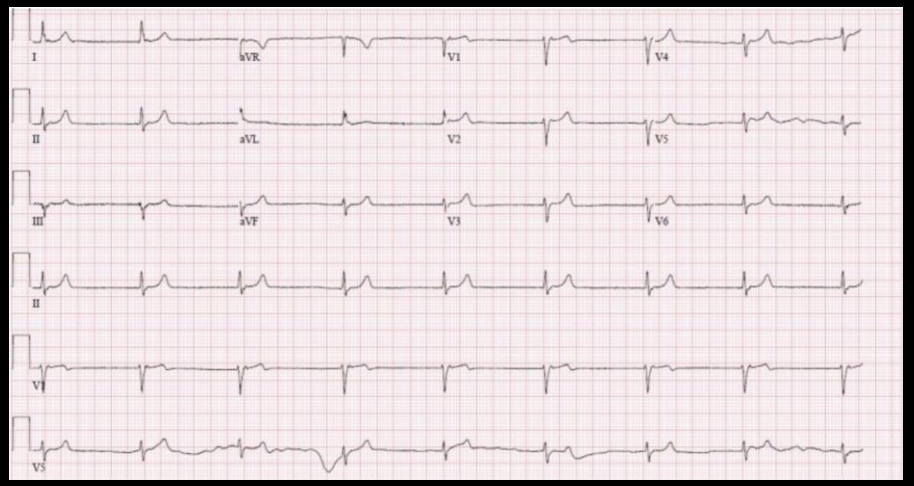
Dx?
Sick sinus syndrome-alternate brady and tachy
Tx?
Pacing
Pathophys:
Degeneration, fibrosis of SA node and surrounding tissue-older pt, syncope+presyncope



Dx?
Junctional rhythm
Tx?
Pacing if symptomatic, ablation
Pathophys:
Pacing originates in AV node
Variants:
Junctional bradycardia
Junctional escape
Accelerated junctional rhythm (digoxin tox)
Junctional tachycardia

Cardiac Drugs

Calcium channel blockers (diydropyridine)
Amlodipine, clevidipine, nicardipine, nifedipine, nimodipine

Calcium channel blockers (non-diydropyridine)
Diltiazem, verapamil

Nitrates:
MOA:
Increase NO in smooth muscle. Affects veins >> arteries, reduces preload.
Avoid what medication with nitrates?
PDE-5

Statins MOA?
HMG-CoA reductase inhibitor (inhibit conversion of HMG-CoA to mevalonate)

Cardiac glycoside:
Digoxin
Inhibits Na+ /K+ ATPase

Antiarrythmic classes
Class Ia, Ib, Ic
Class II (B blocker)
Class III
Class IV (CCB)